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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 02364PC/IDJ	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. **PCT/AU2003/000384**	International Filing Date *(day/month/year)* 28 March 2003	Priority Date *(day/month/year)* 28 March 2002
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] C07D 307/20, 307/22, 307/24, 309/08, 309/10, 309/14, C07H 5/04, 7/02, 7/04		
Applicant ALCHEMIA PTY LTD et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 19 sheet(s).

3. This report contains indications relating to the following items:

   - I [X] Basis of the report
   - II [ ] Priority
   - III [X] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV [X] Lack of unity of invention
   - V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI [X] Certain documents cited
   - VII [X] Certain defects in the international application
   - VIII [X] Certain observations on the international application

Date of submission of the demand	Date of completion of the report
17 October 2003	7 July 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **STUART BARROW** Telephone No. (02) 6283 2284

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU2003/000384

I. Basis of the report

1. With regard to the elements of the international application:*

- [ ] the international application as originally filed.
- [X] the description, pages **1-78,** as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [X] the claims, pages **79,** as originally filed,
  pages , as amended (together with any statement) under Article 19,
  pages , filed with the demand,
  pages **80-98,** received on **25 June 2004** with the letter of **25 June 2004**
- [ ] the drawings, pages , as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [ ] the sequence listing part of the description:
  pages , as originally filed
  pages , filed with the demand
  pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

- [ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- [ ] the language of publication of the international application (under Rule 48.3(b)).
- [ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- [ ] contained in the international application in written form.
- [ ] filed together with the international application in computer readable form.
- [ ] furnished subsequently to this Authority in written form.
- [ ] furnished subsequently to this Authority in computer readable form.
- [ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- [ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets/fig.

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be nonobvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos: **1-30 (in part)**

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination *(specify)*:

☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. **1-30 (in part)** are so unclear that no meaningful opinion could be formed *(specify)*:

As noted in box VIII, the claims are directed towards compounds defined ambiguously, such that the scope of the claims can not clearly be determined. This report is drawn only towards such subject matter as finds support in the specification, and the inventive concept as communicated by the applicant.

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for said claim Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

☐ restricted the claims.

☐ paid additional fees.

☐ paid additional fees under protest.

☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☒ not complied with for the following reasons:

As discussed in the ISR, the claims lack a unifying special technical feature that would allow the present application to be considered a single invention. The special technical feature as communicated by the applicant, "a monosaccharide with peptide mimetics attached," is not an explicit or essential feature in the present claims, and the present claims are not limited to this concept. Moreover, this feature is known in the art.

In the absence of any special technical feature to provide unity to the claims, it is considered that the present claims represent a large number of inventions based on common structural motifs. Due to the very large number of compounds claimed, the diverse structural motifs of these compounds, and the very high likelihood of anticipation, a full search of the present claims was not possible for economic reasons.

However, a limited search was carried out on the basis of the inventive concept as communicated by the applicant.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☐ all parts.

☒ the parts relating to claims Nos. **1-30 (in part)**

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims **1-22, 25-29**	**YES**
	Claims **23, 24, 30**	**NO**
Inventive step (IS)	Claims **1-22, 25-29**	**YES**
	Claims **23, 24, 30**	**NO**
Industrial applicability (IA)	Claims **1-30**	**YES**
	Claims	**NO**

2. Citations and explanations (Rule 70.7)

The following citations have been considered:

D1: Gruner et al., Chem. Rev. 2002, 102, pp491-514.

D2: WO 1998/008799

D3: Smith et al. Chem. Commun. 1998, p2039-2040.

Novelty

D1 is a review article discussing carbohydrate-based mimetics in drug design. Among the compounds disclosed, a number fall within the broad definition of claim 30. For example, compounds 28, 26, 105, 113, 114 and 118 are included in the scope of claim 30 and do not appear to be disclaimed by the disclaimer. Note that the disclaimer is unclear in this regard. See box VIII.

D2 describes the use of aminosugars as molecular scaffolds for the synthesis of polysaccharides. Figure 3 in particular provides a schematic illustration of the use of a carbohydrate where R1 is N(Z)Y. The figure indicates that the 6'-hydroxyl is orthogonally protected. It is noted that the example demonstrates a compound where all of the groups corresponding to X2 in the present claims are the same. Nevertheless, it is considered that the broad teaching of this document is clear to the person skilled in the art, and anticipates claims 23 and 24. The compounds of claim 30 are similarly considered to have been broadly disclosed in D2.

D3 discloses compound 4, 6 and 12, which fall within the scope of the present claim 30 where R1 is C(Z)Y, Y is (=O), U is alkoxy and R5 is N(Z)Y where Z and Y are H, or Z is H and Y is acetyl.

Claim 30 is considered to lack novelty in the light of documents D1-D3.

Note that while only three documents are cited, it is considered highly likely that more relevant art exists. While the applicant has attempted to remove the compounds disclosed in the citations by proviso, this approach is unlikely to remove all anticipating compounds from the scope of the claim. Note also that it is not possible to determine the full scope of the claim. See box VIII.

Inventive Step

The problem as expressed in the specification is the provision of combinatorial approach to the provision of monosaccharide compounds as test compounds for drug discovery. However, as the compounds are claimed individually, this is not considered an essential feature of the claims as presently drafted. Therefore, the problem is considered to be the provision of individual such monosaccharides. It can be seen from D1 and D2 that such monosaccharides are known in the art and, more importantly, that the concept of providing monosaccharide compounds as test compounds for drug discovery is known. Similarly, the concept of using monosaccharide with peptide mimetics attached, the inventive concept as communicated by the applicant, is known. However, with the exception of those of claim 30, the presently claimed compounds are not directly taught by D1 and D2.

Continued on Separate Sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
P, X WO 2002/032915	25 April 2002	17 October 2001	17 October 2000
P, X WO 2002/032963	25 April 2002	18 October 2001	18 October 2000

WO 2002/032915 broadly discloses compounds similar to those presently claimed where R1 is N(Y)Z. The specific examples are not within the scope of the present claims, but the generic disclosure includes the subject matter of the present claims.

WO 2002/032963 broadly discloses compounds similar to those presently claimed where R1 is N(Y)Z. The specific examples have been removed from the scope of the present claims by proviso.

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Original page 95, which formerly contained the list of documents referred to in the specification, has been removed from the specification by amendment without being replaced. The specification is therefore incomplete.

Page 79 containing the first part of original claim 1 was not replaced by the amendments of 25 June 2004. This page should be deleted from the specification. This report has been based on the new claims starting with claim 1 on new page 80.

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

- Claims 3 and 4 are not clear; these claims define a moiety that is not possible in the definition of claim 1, to which it is appended.
- The proviso to claim 30 is not clear. With regard to proviso (c), the definitions of R1 (where R1 is C(Z)Y) and the moiety -C(R5)(R6)(R7) are different but overlap significantly. Disclaiming the case where Z is (=O) and R5 is N(T)Y still allows the case where R6 and R7 are a carbonyl and R1 is substituted amino. Ambiguity is created as to which compounds are still included in the claims.
- The phrase "aminoaryl" is repeated in the definition of group U.
- It is clear from the examples and the context of the claims that the groups "alkyl, aryl, alkenyl, heteroalkyl" and the like are intended to be interpreted broadly, inclusive of substituents. However, there is no clear definition of which substituents are to be included. At present it is considered that the definition of "substituted" is unclear. The claims therefore are considered to lack clarity.
- The claims are not supported by the description as they define a very large range of compounds which are defined ambiguously, such that the full scope of the disclosure can not clearly be determined. The claimed compounds include a diversity of structural motifs including a large number of variables, with insufficient representation in the specification. The claims appear to go well beyond the range of compounds exemplified and described in the specification, and are thus not fully supported by the description.

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

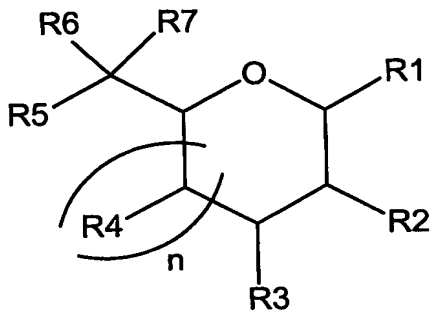
Continuation of Box V

Industrial Applicability

The applicant indicates that the claimed compounds possess industrial applicability as "stabilised drug like molecules" on the basis of the compounds' chemical structure. Industrial Applicability is acknowledged for claims 1-30.

Claims:

1. A compound of formula I



formula I

Wherein,

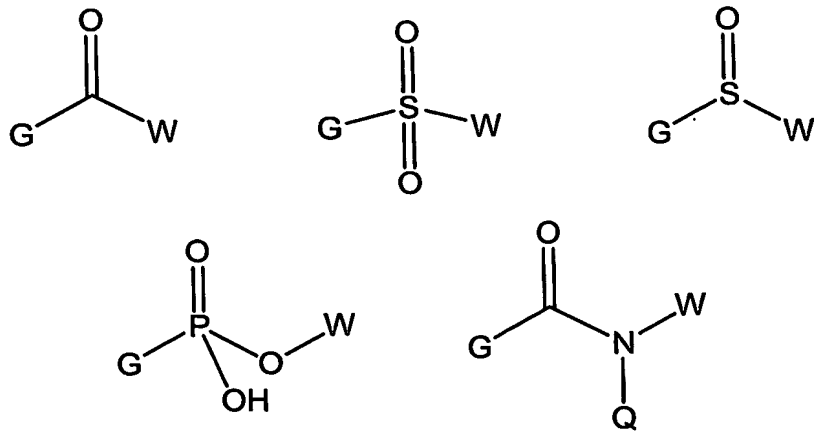
n is 0 or 1;

R1 is selected from the group consisting of hydrogen or -N(Z)Y wherein;

When R1 is –N(Z)Y, then:

R6 and R7 are hydrogen;

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of substituted or unsubstituted alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of substituted or unsubstituted alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

at least one of the groups R2, R3, R4 and R5 is selected from the group consisting of –OX2 or -N(T)Y, and the others of the groups R2, R3, R4 and R5 are independently selected from hydrogen, -OH, -OX2, -N(T)Y, wherein Y is as defined above, T is selected from hydrogen or X2; and X2 is independently selected from substituted or unsubstituted alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

With the provisos that:

a. X2 may not be another carbohydrate ring, a cyclitol ring or contain another carbohydrate ring,
b. all of the X2 substituents may not be the same;

When R1 is H,

R6 and R7 are hydrogen, or together form a carbonyl oxygen;

at least two of the groups R2, R3, R4 and R5 are selected from the group consisting of –OX2 or -N(T)Y, and the others are independently selected from hydrogen, -OH, -OX2, -N(T)Y, wherein Y is as defined above, T is selected from hydrogen or X2; and X2 is independently selected from substituted or unsubstituted alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

With the provisos that:

c. X2 may not be another carbohydrate ring, a cyclitol ring or contain another carbohydrate ring,
d. all of the X2 substituents may not be the same.

2. The compound of claim 1, wherein wherein the ring is selected from the pyran or furan form and the anomeric center is selected from the α or β configuration.

3. The compound of claim 1, wherein the groups Z and Y are combined to form a monocyclic or bicyclic ring structure of 4 to 10 atoms.

4. The compound of claim 3, wherein the ring structure is further substituted with X1 groups.

5. The compound of claim 1 in wherein W is substituted with a moiety selected from the group consisting of OH, NO, NO_2, NH_2, N_3, halogen, CF_3, CHF_2, CH_2F, nitrile, alkoxy, aryloxy, amidine, guanidiniums, carboxylic acid, carboxylic acid ester, carboxylic acid amide, aryl, cycloalkyl, heteroalkyl, heteroaryl, aminoalkyl, aminodialkyl, aminotrialkyl, aminoacyl, carbonyl, substituted or unsubstituted imine, sulfate, sulfonamide, phosphate, phosphoramide, hydrazide, hydroxamate, hydroxamic acid.

6. The compound of claim 1 in wherein X1 is substituted with a moiety selected from the group consisting of OH, NO, NO_2, NH_2, N_3, halogen, CF_3, CHF_2, CH_2F, nitrile, alkoxy, aryloxy, amidine, guanidiniums, carboxylic acid, carboxylic acid ester, carboxylic acid amide, aryl, cycloalkyl, heteroalkyl, heteroaryl, aminoalkyl, aminodialkyl, aminotrialkyl, aminoacyl, carbonyl, substituted or unsubstituted imine, sulfate, sulfonamide, phosphate, phosphoramide, hydrazide, hydroxamate and hydroxamic acid.

7. The compound of claim 1, wherein Y is hydrogen.

8. The compound of claim 1 in wherein X2 is substituted with a moiety selected from the group consisting of OH, NO, NO_2, NH_2, N_3, halogen, CF_3, CHF_2, CH_2F, nitrile, alkoxy, aryloxy, amidine, guanidiniums, carboxylic acid, carboxylic acid ester, carboxylic acid amide, aryl, cycloalkyl, heteroalkyl, heteroaryl, aminoalkyl, aminodialkyl, aminotrialkyl, aminoacyl, carbonyl, substituted or unsubstituted imine, sulfate, sulfonamide, phosphate, phosphoramide, hydrazide, hydroxamate and hydroxamic acid.

9. The compound of claim 1 wherein at least three of the groups R2, R3, R4 and R5 are selected from –OX2 or -N(T)Y;

10. The compound of claim 1 wherein R1 is hydrogen.

11. The compound of claim 10 wherein independently at least one of R2, R3, R4, or R6 is -N(T)Y, and at least one is –OX2.

12. The compound of claim 10 wherein independently at least two of R2, R3, R4, or R6 are –OX2.

13. The compound of claim 10 wherein at least two of R2, R3, R4, or R6 is -N(T)Y.

14. The compound of claim 1 wherein R1 is -N(Z)Y.

15. The compound of claim 14 wherein at least one of R2, R3, R4, or R6 is -N(T)Y.

16. The compound of claim 14 wherein at least two of R2, R3, R4, or R6 is -N(T)Y.

17. The compound of claim 14 wherein at least two of R2, R3, R4, or R6 are –OX2.

18. A method of synthesis of compounds of claim 10, wherein n is 1, comprising the step of reducing a synthetic intermediate of formula III,

in which

V is bromine or chlorine,

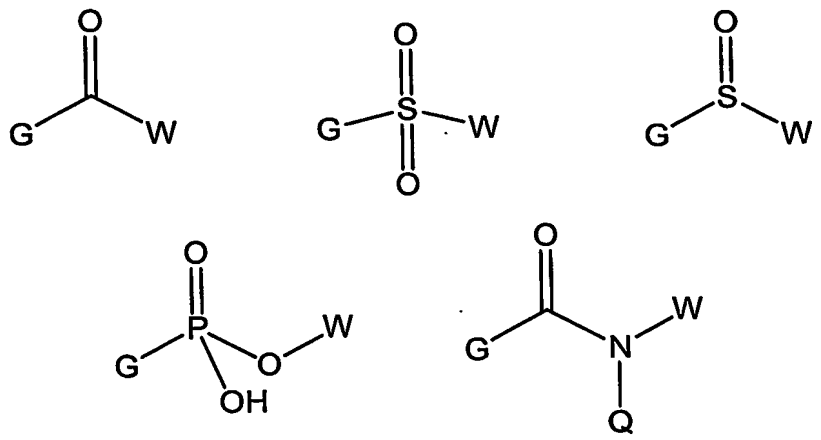
R6 and R7 are hydrogen, or together form a carbonyl oxygen,

R5, R4, R3, and R2 are selected from the group consisting of OH, O-acyl, N_3, NHDde, NHDTPM, NHZ, NHBOC, phthalimide, OX2, N(T)Y and an O-protecting group,

X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

T is hydrogen or X2,

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(T)Y;

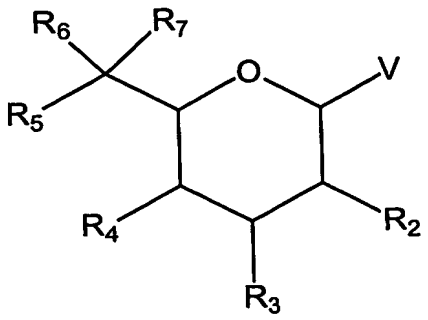


Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,



general formula III

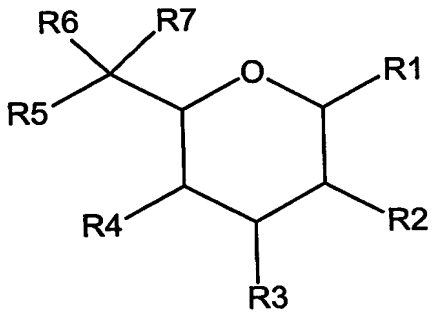
19. The method of claim 18, wherein R6 and R7 together form a carbonyl oxygen and R5 is O-alkyl, O-arylalkyl or O-aryl.

20. The method of claim 19, wherein the R5 substituent is substituted with a moiety selected from the group consisting of OH, NO, NO_2, NH_2, N_3, halogen, CF_3, CHF_2, CH_2F, nitrile, alkoxy, aryloxy, amidine, guanidiniums, carboxylic acid, carboxylic acid ester, carboxylic acid amide, aryl, cycloalkyl, heteroalkyl, heteroaryl, aminoalkyl, aminodialkyl, aminotrialkyl, aminoacyl, carbonyl, substituted or unsubstituted imine, sulfate, sulfonamide, phosphate, phosphoramide, hydrazide, hydroxamate, hydroxamic acid.

21. The method of claim 18, wherein the O- protecting groups comprise acetals and ketals which protect two adjacent oxygens.

22. A method of synthesis of compounds according to claim 14, in which n is 1, comprising the step of reacting a compound of formula III with an azide nucleophile, to form an anomeric azide and reduction of the anomeric azide to form an anomeric amine and reaction of the anomeric amine with an electrophile.

23. A method of combinatorial synthesis of compounds of claim 1, wherein n is 1, comprising the step of immobilizing a compound of formula IV onto a support.



general formula IV

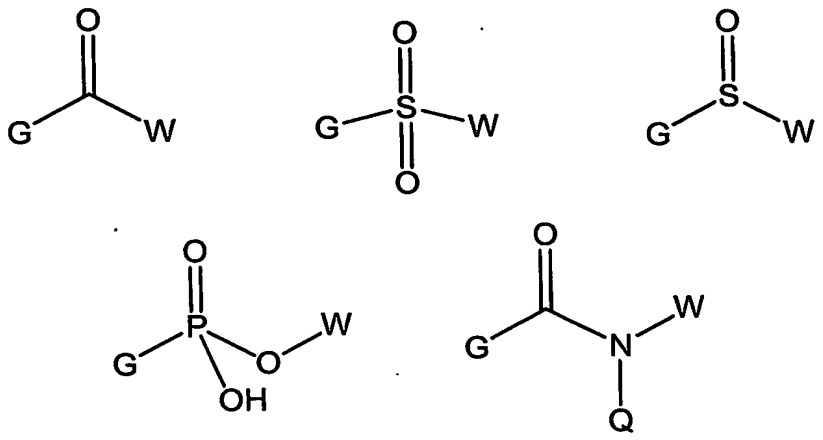
wherein

R6 and R7 are hydrogen, or together form a carbonyl oxygen;

R1 is selected from the group consisting of hydrogen; -N(Z)Y and -C(Z)Y wherein;

When R1 is –N(Z)Y, then:

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

When R1 is –C(Z)Y, then:

Y is selected from the group consisting of two hydrogen atoms, a double bonded oxygen (=O) to form a carbonyl, and a triple bonded nitrogen to form a nitrile,

Z is absent, or is selected from hydrogen or U,

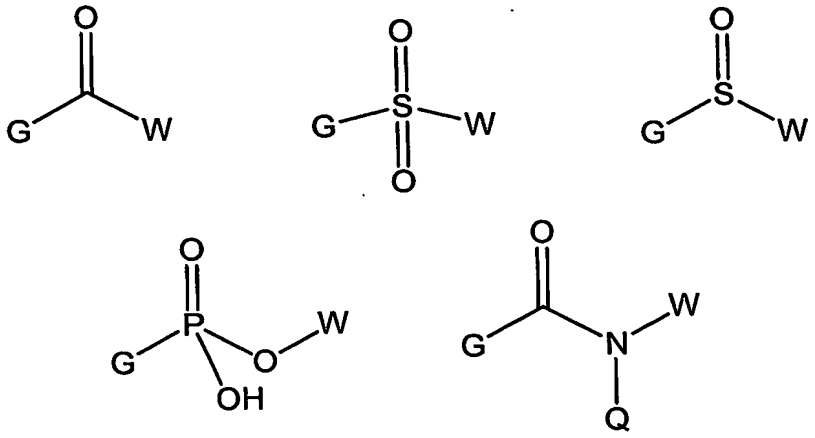
Wherein U is selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aminoalkyl, aminoaryl, aryloxy, alkoxy, heteroaryloxy, aminoaryl, aminoheteroaryl, thioalkyl, thioaryl or thioheteroaryl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

R5, R4, R3, and R2 are selected from the group consisting of OH, O-acyl, N_3, NHDde, NHDTPM, NHZ, NHBOC, phthalimide, OX2, N(T)Y and an O-protecting group, and the linkage between the compound of formula IV and the support is through any one of positions R1, R2, R3, R4 or R5,

X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

T is hydrogen or X2,

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

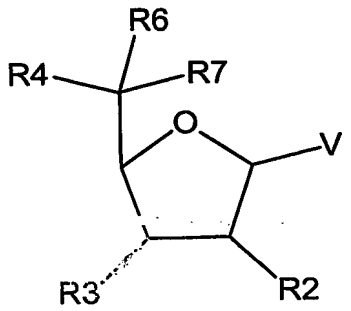
Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

24. The method of claim 23 wherein the support is selected from the group consisting of derivatised polystyrene, tentagel, wang resin, MBHA resin, aminomethylpolystyrene, rink amide resin DOX-mpeg, and polyethylene glycol.

25. A method of synthesis of compounds according to claim 13, in which n is 0, comprising the step of reacting a compound of formula V in the presence of a lewis acid with an azide source to form an anomeric azide, reduction of the anomeric azide to form an anomeric amine and reaction of the anomeric amine with an electrophile.



general formula V

in which V is -OAcyl,

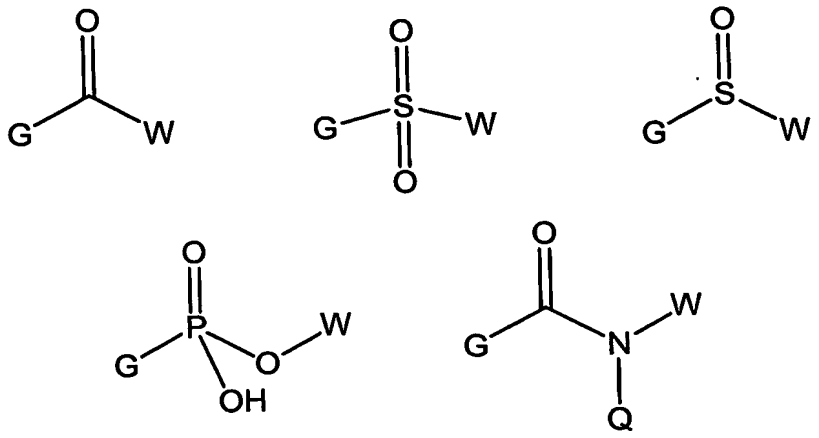
R6 and R7 are hydrogen, or together form a carbonyl oxygen,

R4, R3, and R2 are selected from the group consisting of OH, O-acyl, N_3, NHDde, NHDTPM, NHZ, NHBOC, phthalimide,OX2, N(T)Y and O-protecting group,

X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

T is hydrogen or X2,

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

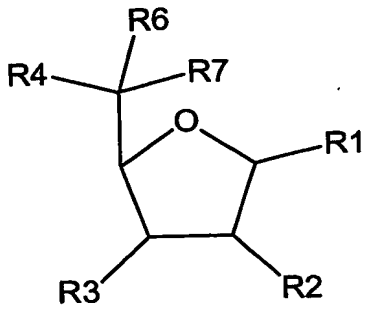
Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

26. The method of claim 25, wherein R6 and R7 together form a carbonyl oxygen, and R4 is substituted O-alkyl, O-arylalkyl or O-aryl.

27. A method of combinatorial synthesis of compounds of claim 1, wherein n is 0, comprising the step of immobilizing a compound of formula VI onto a support,

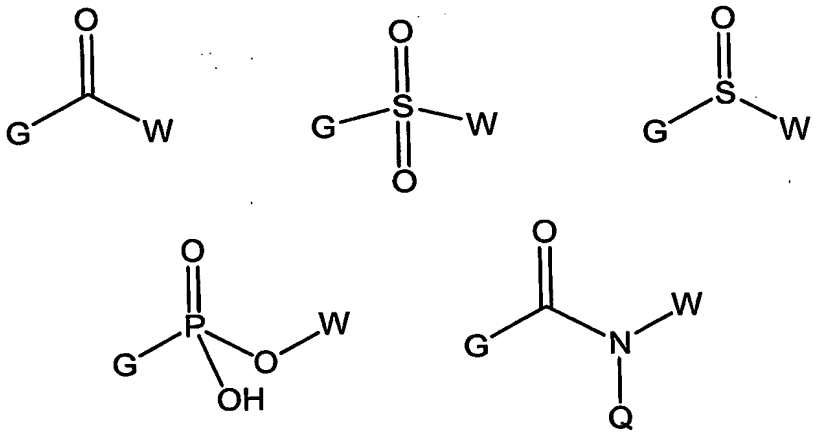


general formula VI

Wherein R1 is selected from the group consisting of hydrogen; -N(Z)Y and -C(Z)Y wherein;

When R1 is –N(Z)Y, then:

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

When R1 is –C(Z)Y, then:

Y is selected from the group consisting of two hydrogen atoms, a double bonded oxygen (=O) to form a carbonyl, and a triple bonded nitrogen to form a nitrile,

Z is absent, or is selected from hydrogen or U,

Wherein U is selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aminoalkyl, aminoaryl, aryloxy, alkoxy, heteroaryloxy, aminoaryl, aminoheteroaryl, thioalkyl, thioaryl or thioheteroaryl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

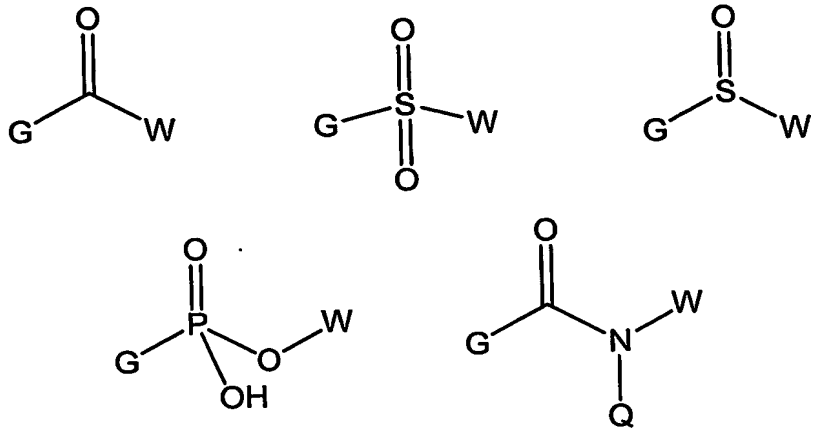
R6 and R7 are hydrogen, or together form a carbonyl oxygen,

R4, R3, and R2 are selected from the group consisting of OH, O-acyl, N_3, NHDde, NHDTPM, NHZ, NHBOC, phthalimide, OX2, N(T)Y and O-protecting group,

X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

T is hydrogen or X2,

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms ,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

and the linkage between the compound of formula VI and the support is through any one of positions R1, R2, R3, or R4.

28. The method of claim 27, wherein the support is selected from the group consisting of derivatised polystyrene, tentagel, wang resin, MBHA resin, aminomethylpolystyrene, rink amide resin DOX-mpeg,and polyethylene glycol.

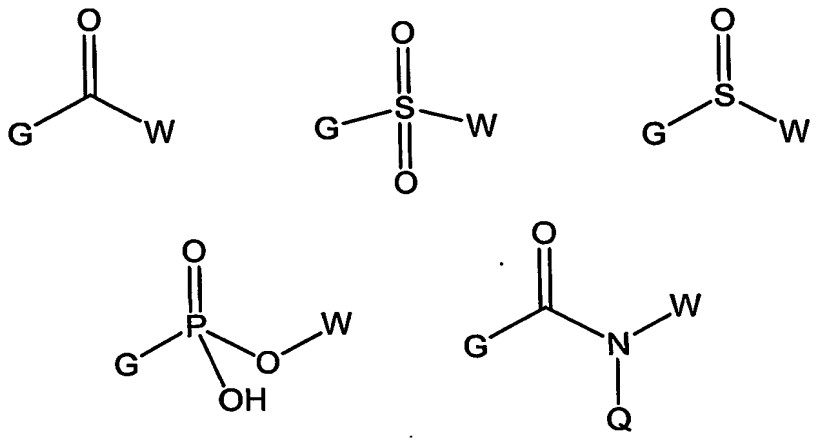
29. A method of solution phase combinatorial synthesis of compounds of claim 1, comprising the step of alkylating a free hydroxyl on a compound of formula IV or formula VI, wherein

R6 and R7 are hydrogen, or together form a carbonyl oxygen;

R1 is selected from the group consisting of hydrogen; -N(Z)Y and -C(Z)Y wherein;

When R1 is –N(Z)Y, then:

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

When R1 is –C(Z)Y, then:

Y is selected from the group consisting of two hydrogen atoms, a double bonded oxygen (=O) to form a carbonyl, and a triple bonded nitrogen to form a nitrile,

Z is absent, or is selected from hydrogen or U,

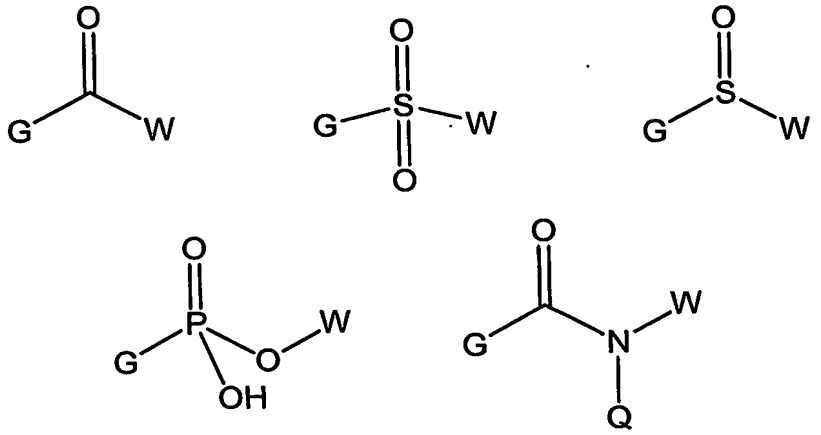
Wherein U is selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aminoalkyl, aminoaryl, aryloxy, alkoxy, heteroaryloxy, aminoaryl, aminoheteroaryl, thioalkyl, thioaryl or thioheteroaryl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

R5, R4, R3, and R2 are selected from the group consisting of OH, O-acyl, N_3, NHDde, NHDTPM, NHZ, NHBOC, phthalimide, OX2, N(T)Y and an O-protecting group,

X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

T is hydrogen or X2,

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

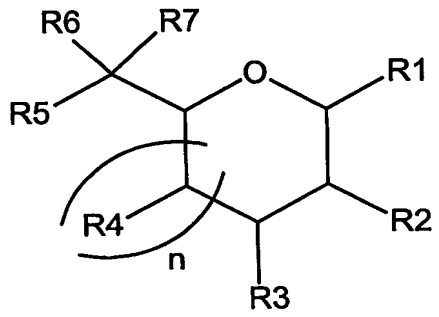
Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

and any one of the protecting substituents may be removed prior to alkylation.

30. **A compound of formula I**



formula I

Wherein,

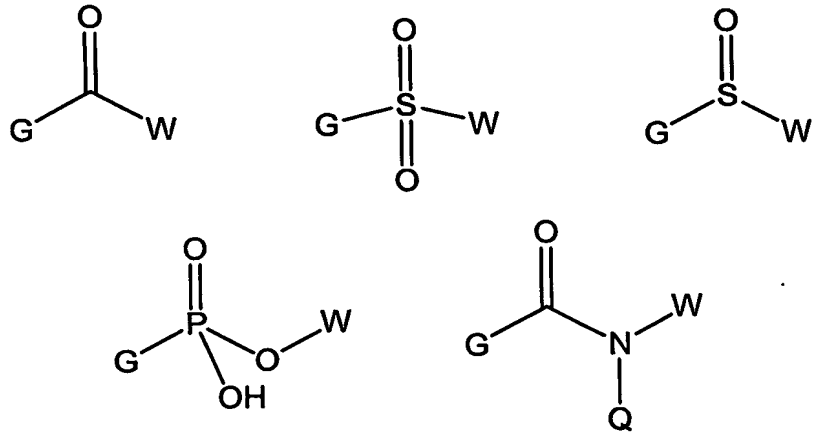
n is 0 or 1;

R6 and R7 are hydrogen, or together form a carbonyl oxygen;

R1 is selected from the group consisting of hydrogen; -N(Z)Y and -C(Z)Y wherein;

When R1 is –N(Z)Y, then:

Y is selected from hydrogen, or the following, where G denotes the point of connection to the nitrogen atom in N(Y)Z;



Z is selected from hydrogen or X1;

Q is selected from hydrogen or W;

The groups W are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

The groups X1 are independently selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

When R1 is –C(Z)Y, then:

Y is selected from the group consisting of two hydrogen atoms, a double bonded oxygen (=O) to form a carbonyl, and a triple bonded nitrogen to form a nitrile,

Z is absent, or is selected from hydrogen or U,

Wherein U is selected from the group consisting of alkyl, alkenyl, alkynyl, heteroalkyl, aminoalkyl, aminoaryl, aryloxy, alkoxy, heteroaryloxy, aminoaryl, aminoheteroaryl, thioalkyl, thioaryl or thioheteroaryl, acyl, arylacyl, heteroarylacyl, aryl, heteroaryl, arylalkyl and heteroarylalkyl of 1 to 20 atoms,

When R1 is H, at least two of the groups R2, R3, R4 and R5 are selected from the group consisting of –OX2 or -N(T)Y, and the others are independently selected from hydrogen, -OH, -OX2, -N(T)Y, wherein Y is as defined above, T is selected from hydrogen or X2; and X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

When R1 is N(Z)Y or C(Z)Y, at least one of the groups R2, R3, R4 and R5 are selected from the group consisting of –OX2 or -N(T)Y, and the others are independently selected from hydrogen, -OH, -OX2, -N(T)Y, wherein Y is as defined above, T is selected from hydrogen or X2; and X2 is independently selected from alkyl, alkenyl, alkynyl, heteroalkyl, aryl, heteroaryl, arylalkyl or heteroarylalkyl of 1 to 20 atoms,

With the provisos that:

a X2 may not be another carbohydrate ring, a cyclitol ring or contain another carbohydrate ring,

b all of the X2 substituents may not be the same, and

c when R1 is C(Z)Y, and Z is C=O and R5 is N(T)Y, both T and Y may not be hydrogen, or Y may not be an amino acid or peptide.